Financing Community Energy Case Studies:

Green Energy Mull

UKERC UK Energy Research Centre

University of Strathclyde Glasgow

MANCHESTER 1824 The University of Manchester

TyndallManchester Climate Change Research

Grantham Institute Climate Change and the Environment An institute of Imperial College London

Authors

Iain Cairns and Matthew Hannon,
University of Strathclyde

Tim Braunholtz-Speight, Carly McLachan, Sarah Mander,
Edward Manderson and Maria Sharmina,
University of Manchester

Jeff Hardy, Grantham Institute,
Imperial College London

Please contact Dr Matthew Hannon for more details about the project: **matthew.hannon@strath.ac.uk**

Please reference report as: Cairns, I., Hannon, M., Braunholtz-Speight, Tim., Hardy, J., McLachan, C., Mander, S., Manderson, E., Sharmina, M. (2020) Financing Community Energy Case Studies: Financing Community Energy Case Studies: Green Energy Mull, UKERC: London. DOI https://doi.org/10.17868/69788

Front cover: Garmony Hydro plant, Isle of Mull (LES, 2015)

Contents

Preface

Financing Community Energy project

Commencing in 2016, the Financing Community Energy project aims to provide the first systematic quantitative and qualitative analysis of the role of finance in the evolution of the UK community energy sector. It is led by the University of Manchester, working with the University of Strathclyde and Imperial College London, and forms part of the UK Energy Research Centre (UKERC) research programme.

The project involves a literature and data review analysing the development of community energy to date; a UK-wide survey and statistical analysis of community energy finances and business models; in-depth case studies of a range of community energy business models in practice; and an ongoing stream of policy and practice engagement.

This report presents the second of four case studies of UK community energy organisations conducted during 2018/19. These will later be included as part of a synthesis briefing alongside a series of sector-level interviews. The case study makes use of a combination of qualitative (e.g. interviews, organisation reports) and quantitative (e.g. financial reports) data.

UK Energy Research Centre

This project was undertaken as part of the UKERC programme, funded by the Research Councils Energy programme. UKERC carries out world-class interdisciplinary research into sustainable future energy systems. It is a focal point of UK energy research and a gateway between the UK and the international energy research communities. Our whole-systems research informs UK policy development and research strategy.

For information please visit: **www.ukerc.ac.uk**

Follow us on Twitter **@UKERCHQ**

Green Energy Mull key facts

Year established	2013
Location	Mull, Scotland
Legal structure	Community Benefit Society (BenCom)
Annual turnover	£242,000 (2018)
Net surplus	£20,078[1] (2018)
Total assets	£1.43m (2018)
Generation capacity	400 kW (run of river Hydro), estimated to provide 1 GWh per annum (~280 homes and 3.5% of island's demand (CES, 2018)
Finance	Combination of loans and community shares
Subsidies	Combination of grants and long-term revenue payments, e.g. Feed-in-Tariff (FiT)
Number of FTE staff	Green Energy Mull (GEM) has no full-time staff, but Mull and Iona Community Trust employed a project manager to be responsible for the Hydro project
Number of regular volunteers	Fewer than 10
Number of members	216
Key partnerships	Mull and Iona Community Trust, Community Energy Scotland, The Waterfall Fund, Forestry and Land Scotland

(Source: interviews; company accounts 2018)

Summary of key lessons

- **Government subsidy is the cornerstone to securing both community and private finance.** By providing a substantial long-term guaranteed revenue stream, the FiT allowed GEM to raise community investment and further investment from commercial and state-backed lenders. Even with the FiT in place, sourcing commercial finance was challenging. In its absence, it is unlikely that commercial lenders will lend.
- **The ability to raise community finance is dependent on the affluence and population density of a locality.** Unable to raise all the finance it needed from the community of Mull, the organisation was forced to access more expensive loan finance.
- **Communities present important test beds for innovation, but direct long-term benefits may not be forthcoming.** In its role as a trusted local organisation, GEM demonstrated an important role for community energy in facilitating innovation, but the extent to which it has been able to benefit from this is questionable.
- **Partnerships with public landowners are critical to project delivery.** Forestry and Land Scotland made land available for use by GEM, which was critical to their hydro scheme. Without this the project could not have taken place.

1 This sum does not include the £35,000 allocated by GEM to their community benefit fund (Company Accounts, 2018).

1 Mission statement and value proposition

GEM is a Community Benefit Company (BenCom) that owns and operates Garmony Hydro. It is a run-of-the-river hydro scheme, located near the east coast of the island of Mull, part of the Inner Hebrides of Scotland (Figure 1). The "overriding" purpose of GEM is the creation of a revenue stream for investment in "long term transformational sustainable change" for the islands of Mull, Iona and smaller neighbouring islands (I21).[2] Making a positive contribution to the environment is an important albeit secondary objective (I21).

GEM generates its revenue from exporting electricity generated by the hydro to the grid and from subsidies such as the Feed in Tariff (FiT). Any surplus revenue is gifted to the Waterfall Fund (see Section 4.5.3), a charity specifically set up for the project to distribute the funds to worthy causes around the local islands.

Figure 1: GEM project location (Source: Google and the Waterfall Fund)

2 Origins and development

GEM owes its origins to Mull and Iona Community Trust (MICT), a community development charity founded in 1997. MICT's role is to "formulate strategies and provide practical support to local projects aimed at improving the social amenities, and physical and economic infrastructure of the islands" (MICT, 2019a). An informal organisation called Mull and Iona Renewables grew around MICT, essentially "a group of people who started off having a chat about what could the island do" in relation to renewable energy (I21).

Members of the group became more proactive with the introduction of the FiT in 2010. They convinced others in the broader MICT organisation that the development of energy assets could "be a very significant income generator for the island" (I21). As a result, MICT began investigating the prospect of creating some kind of electricity generation asset.

During this time, MICT built up a relationship with Community Energy Scotland (CES), which would both advise the group throughout the development process and provide financial assistance in the form of grants for feasibility work, through the Community & Renewable Energy Scheme (CARES) grants scheme (see Section 4.5.4). The feasibility study identified a potentially suitable site for a hydro scheme. It also estimated total capital costs for project delivery to be between £800,000 and £1.3m (Green Energy Mull, 2014).[3]

2 For the full list of interviewees in this case study, see Appendix A.
3 Our Financing Community Energy survey records the actual costs at £1.4m (S1).

There were various hurdles to be overcome before money could be raised for construction. These included obtaining planning permission from Argyll and Bute Council and a water extraction license from the Scottish Environmental Protection Agency, both achieved in 2012. Moreover, informal discussions had commenced with the Scottish Government agency Forestry and Land Scotland (FLS),[4] on whose land the group hoped to construct the hydro, about establishing a 40-year lease of the site.

The project leadership had particular struggles around pre-accreditation[5] (LES, 2015). The hydro was pre-accredited in December 2012, with the express purpose of benefitting from a new FiT subsidy band exclusively for 100–500 kW hydro schemes. However, the group was not informed that the implementation of the band had been delayed, leading the project to be pre-accredited at a lower rate than initially intended (LES, 2015). After an appeal to the Secretary of State, the project was able to pre-accredit at a higher rate. Even so, the greatest challenge reported by the group – which threatened the entire project – was securing a grid connection (I21; I22) (see Section 4.1).

Community shares were prioritised as a source of funding, with any shortfall being made up by loans. MICT was "instrumental" in establishing GEM a BenCom, in September 2013 to raise a share offer to finance the hydro project (I22). The following month, the share offer was launched, targeting a minimum of £333,000. The target was ultimately exceeded, with £485,000 raised by mid-2014. Having obtained more than a third of the cost for the project through the share offer, GEM then applied for and obtained the remaining funds as a loan from the Charity Bank and the Scottish Government-backed Renewable Energy Investment Fund (REIF[6]) (Section 4.5.4).

In 2015, Local Energy Scotland (LES) awarded £1.8m to a Community Energy Scotland-led consortium, which included MICT, to deliver the Assisting Communities to Connect to Electrical Sustainable Sources (ACCESS) project. The objective of ACCESS was to identify ways of overcoming grid constraints, using load control, network monitoring and innovative communication systems (Section 4.1). Shortly afterwards, in June 2015, Garmony Hydro began generating power. The ACCESS project came to an end in April 2017.

Table 1: Timeline of milestones

1997	MICT founded as a charitable company limited by guarantee (CLG).
2012	A feasibility study is conducted, and MICT launches a business plan to develop a hydro facility on Mull.
2013	**September:** Green Energy Mull, a BenCom, established by MICT to finance a hydro project.
	November: community share offer launched.
2014	£485k raised in community shares (S1).
	May: construction starts
2015	**January:** the Waterfall Fund charity established to distribute grants derived from surplus of hydro project.
	March: LES awarded a £1.8m grant for the ACCESS demonstration project.[7]
	April: ACCESS project begins.
	June: Garmony Hydro begins generating electricity.
2017	**April:** ACCESS project comes to an end.

(Source: interviews; company accounts)

3 Legal structure

A key consideration for the establishment of a BenCom was to deploy it as a "special purpose vehicle" to raise sufficient funds to enable the hydro project to take place, but for it to be "independent of the charitable activities that MICT carries out" (I22). The formal separation of MICT from the legal owner and operator of the hydro facility was considered important for several reasons.

Firstly, the creation of a new company was required "because of the financial risk to the parent charity that was perceived by the creation of the renewable energy scheme", which "if it went wrong … could have wiped out the charity" (I22). Secondly, there was the matter of public opinion. The group did not want the endeavour to be perceived merely as an attempt to raise money for MICT; it was therefore important to MICT's leadership that it was made "sure that in terms of local opinion it was seen to be totally separate" (I22).

A share issue was considered the most obvious way to raise the finance for the project (see Section 4.5.4), however the conventional route of forming a public limited company (PLC) was rejected for ethical reasons. As the GEM project manager explains:

"[I]f you talk to any lender [they say] just make yourself a public limited company and sell shares … but of course then our sort of ethical background kicks in, and you say, well, you don't want somebody with more shares having more control than somebody with only one or two" (I21).

4 At the time of the project's development, the MICT dealt with Forestry Commission Scotland (FCS). Since then, FCS's responsibilities have been taken over by a new body called Forestry and Land Scotland (Forestry Commission Scotland, 2019).
5 Pre-accreditation means that a project is registered for a specific rate of FiT applicable at the time of registration, not the rate at the time when it is actually built.
6 Now called the Energy Investment Fund (EIF) (Scottish Enterprise, 2019).
7 The total cost of the project was £2.5m. It was released in two phases, the first phase being £1.8m.

Table 2: Comparison between ordinary and community shares

Ordinary shares (issued by PLC or CIC)	Community shares (issued by BenComs or bona fide cooperatives)
One share, one vote: • Greater number of votes in key company meetings depending on the ownership stake.	**One shareholder, one vote:** • Each member has one vote in key company meetings regardless of size of financial stake in company.
Strict regulatory compliance: • Accounts must be independently audited. • Company must stand on its own accounts. • Financial Services Ombudsman (FSO) settles disputes between sellers and purchasers of PLC shares.	**Light regulatory compliance:**[8] • No independent audit required. • No FSO dispute resolution.
Expensive: £10,000 or more for initial share offer.	**Approx.** £700 for initial share offer. A cap of £100,000 on any single investment held by one shareholder.
Highly liquid: • Ordinary shares are traded on London Stock Exchange. • A familiar financial instrument for institutional investors, such as banks or investment firms and can therefore attract large sums. • Shares can be sold for more or less than the price at which they were initially sold.[9]	**Illiquid:** • Community shares cannot be traded and can only be withdrawn from the issuing society. • Community shares cannot be sold for more than their face value, but may decrease in value.

(Source: Community Shares Unit, 2019; I8; I12; I21)

The group also considered setting up a community interest company (CIC), but this was also rejected because "the administrative overheads of creating a CIC that can sell shares to the public were immense" (I21). For a summary of the key features of ordinary shares and community shares see Table 2.

The group also explored cooperative structures, i.e. the bona fide cooperatives and BenCom. However, the broader community benefit element of the BenCom structure was an important factor (for a summary of common legal structures see Appendix C). GEM's project manager explains that in bona fide co-ops there is "closed membership" for those who buy shares; an individual member then "reaps all the benefit" (I21). This refers to the fact that, with the bona fide cooperative structure, the organisation is run specifically in the interests of its members. It need not, as is the case for BenComs, demonstrate the provision of benefit to a wider community which does not include its membership.

In contrast to the other possible legal structures, they found that the BenCom model was "just what we wanted" in that it provided:

1. limited liability for the members and directors;
2. the option of "inviting investments from local people and from like-minded individuals elsewhere";
3. the option to "accept donations" and "take out commercial loans" (I22); and
4. an equitable governance structure: "it was one member, one vote, regardless of how many shares you bought" (I21).

It is, however, worth noting that, in order to qualify as a voting member, shareholders had to hold at least five shares, with a combined value of £250. This meant that only individuals with this level of disposable income were able to shape the direction of GEM. Whilst the BenCom was established to raise funds for the project, and subsequently construct and maintain the hydro, a separate organisation was created to disburse the surplus revenue – a charity called the Waterfall Fund (see Section 4.3.2).

8 Community shares are defined as withdrawable and not transferrable.
9 The shares issued by a CIC are the same as those issued by a PLC and have the same benefits, regulatory compliance issues and costs.

4 Business model

4.1 Activities

The core responsibility of GEM is to oversee management of the hydro facility, but, in practice, many of the core operational activities are carried out by staff of MICT. MICT receives an annual management fee for undertaking these duties.[10] Work involves "arranging and overseeing maintenance operations, metering, accounting, reporting and administration" (Green Energy Mull, 2014: 11). For example, MICT organises weekly checks of Garmony Hydro, to ensure that the intake grille is free of debris, and annual maintenance checks, which are sub-contracted to specialists Argyll Industrial Supplies (I21).

MICT arranges and actions payment for the lease of the land, insurance for the facility, and funds for decommissioning and for the community benefit fund, which it pays to the Waterfall Fund charity (ibid). It has also negotiated the Power Purchase Agreements (PPAs) with suppliers for the sale of electricity to the grid (see Sections 4.2 and 5).

Beyond the management of the hydro facility and associated administrative duties, GEM and the MICT leadership have been involved in ACCESS, a major technology demonstration project. The project was instigated to resolve a key problem facing community energy in remote areas. Mull and Iona, as well as large swathes of the west coast of Scotland, have grid infrastructure in place with insufficient capacity to accommodate significant additional local energy generation.

"We can't get power off the island ... We can't get it further south than about 50 miles north of Glasgow. There is a piece of kit in Taynuilt which isn't big enough. Now, the only way to overcome that is for Ofgem to allow National Grid to spend a vast amount of money ... So, if we wanted to build another scheme, we would be limited to 50 kilowatts that we could export" (I21)

This issue originally threatened to derail the entire GEM project. After the initial work had been completed, and "all the financial viability was done" (I21), MICT approached the Distribution Network Operator (DNO) Scottish and Southern Energy Networks (SSEN) to arrange a grid connection, only to be told that their facility could receive only a 50 kW firm connection to the grid.

Firm grid connections are the "traditional, and prevailing, approach to distribution system planning" (Džamarija and Keane, 2013: 2162). They have been described as a "fit-and-forget" policy, where the amount of output that a generator can export to the grid is fixed by the connection agreement and does not vary depending on conditions (the balance of supply and demand) in the distribution network (Ochoa et al., 2010: 1).

While a firm grid connection agreement may allow a generator to export at full capacity, an assessment is made by the DNO about whether that might threaten the operation of the network under certain conditions. If the assessment concludes that new generation capacity has the potential to cause a fault in the grid network, then the new generator may be curtailed,[11] i.e. it is prohibited from exporting to the grid at full capacity.

In the case of the Mull Hydro project, the GEM leadership was told by SSEN that the transmission network could only accommodate 50 kW of the 400 kW that the hydro plant could potentially generate. This was reflected in a 50 kW connection offer made from the network operator to GEM. Because financial viability calculations had been done on the basis of the facility having no such constraint, the constraint "essentially rendered the project unviable at that point" (I21).

Ultimately, the constraint problem was solved for Garmony Hydro because a planned windfarm project nearby was abandoned, freeing up sufficient capacity on the local grid for Garmony Hydro to operate at full capacity, i.e. regardless of conditions in the local grid. However, with the available capacity taken by Garmony Hydro and other new generators, the area became grid constrained once more, making it very difficult for new generation projects to be commissioned in the future.[12]

Although GEM was no longer affected by the grid constraint, its leadership was well aware of the potential benefits of the ACCESS project for community energy electricity generation in general. Thus, GEM accepted a CES invitation to work with SSEN and several other companies to participate in an experiment to demonstrate the use of load control, network monitoring and innovative communication systems to overcome the problem of the constraint placed on the local grid, through a non-firm grid connection and an active management approach. GEM was specifically chosen, as it already had a firm connection, so there was no risk to the network if the experiment failed (I33). This became the ACCESS project.

The ACCESS project is one example of an experiment regarding alternative, non-firm grid connections currently being initiated by DNOs in the UK (UK Government, 2014). With non-firm grid connections, instead of a cap being placed on how much power a generator can export, DNOs take a more active approach and curtail a generator only "in emergencies or at given times of the day, depending on the contractual agreement between the two parties" (UK Government, 2014: 11). The non-firm connection approach has one key advantage compared to the firm grid connection. The assessment for firm grid connections of whether a new generator's output might destabilise the network is based on a worst-case scenario of "maximum generation at minimum demand" (Ochoa et al., 2010: 1), even though in practice this may mean that "90% of the time, the existing [network] assets can cope" with a generator generating at full capacity (I24).

What this means is that most of the time "capacity [of distributed generators is] restricted despite the opportunity for much higher energy production" (ibid). By taking a more active role in network management by deploying a non-firm connection approach alongside active management of local networks, DNOs are able to facilitate more electricity being exported to the grid from distributed generators.

In this context, the project goals were as follows:

1. "To demonstrate real time balancing of renewable generation (1x 400 kW hydro generator) and distributed demand (c.100x homes and businesses);
2. To develop an affordable network protection and communications system for enabling 'non-firm' grid access to transmission-constrained generators;
3. To engage with and provide benefit to local homes and businesses; and
4. To create the commercial arrangements required for future deployment and roll out ('local heat tariffs')" (CES, 2015: 8).

The experiment had two key elements. The first involved installing safety measures which a) monitored conditions in the local grid and b) allowed the Garmony Hydro facility to be remotely disconnected from the network in the event that the hydro's electricity generation threatened to cause a (simulated[13]) fault condition in the local grid.

The second key element involved balancing local supply from the Garmony Hydro with local electricity demand. The experiment sought to demonstrate that, by distributing electricity "locally, the grid could continue to operate within its statutory voltage limits and margins of safety and still allow new generation to be built and connected" (CES, 2018a: 14). To achieve this, the project sought to monitor and manipulate "controlled loads" to balance supply from the hydro with demand from islanders.

Controlled loads were created by the use of storage heaters, flow boilers[14] and hot water cylinders which were hooked up to monitoring and communications equipment and installed in local properties on the island (CES, 2018). To compensate for the inconvenience of installation work, participants were offered £250 for participating in the full trial (LES & Ricardo Environment, 2018). These technologies were somewhat intrusive; during periods of grid constraint, these heaters could be switched on remotely to consume excess electricity generated in the hydro to protect the local grid.[15] However, outside of times of constraint, heat was available as normal (I33).

Whilst it was envisaged that the new and more efficient heating systems would reduce energy usage and, therefore, households' bills, householders were provided with compensation for any increased energy usage that resulted from the project. When the project came to an end, householders benefitted from keeping the new heating systems in place but now disconnected from the smart grid (Section 4.4.1.2).

GEM had two key roles in the ACCESS project. Firstly, it was involved in the recruitment of local households and businesses for the project. MICT's role was as a trusted intermediary in the community, explaining the nature of the project and the potential benefit to the islanders. In accordance with MICT's social mission, during the recruitment process GEM gave "priority to properties and householders where we felt that they were likely to be in fuel poverty" (I22). From an initial 100 homes that showed interest, a total of 73 properties were included in the project on the basis of compatibility with the proposed heating and control system (I24). The majority of these were privately owned. However, 18 homes were owned by West Highland Housing Association (LES & Ricardo Environment, 2018).

The second key role of the community energy group was to deploy the Garmony Hydro plant in the experiment. This involved making the facility available to be reconnected to the grid using inter-trip technology (see Section 4.4.1.2). GEM could continue to generate as normal, apart from during a small number of test events agreed in advance. During the test events, the generation of Garmony Hydro was reduced, both by switching it off totally and by modulating output in order to match local demand. GEM was reimbursed for any lost generation resulting from simulating curtailment during the trial.

10 In 2017/18, GEM's accounts show administration fees of £3,550 which we assume is the sum paid to MICT for administering the venture (GEM, 2019).
11 "Curtailment is a reduction in the output of a generator from what it could otherwise produce given available resources, typically on an involuntary basis" (Bird, Cochran and Wang, 2014 p.iv). Naturally, this can have a negative impact on the pay-back period the hydro scheme would offer.
12 The restriction of limiting a new generator's export to a maximum 50kW currently applies to much of Argyll and other areas of Scotland (CES, 2018).
13 In reality, this was an artificial constraint as, at the time of the ACCESS project, Garmony Hydro was not grid constrained.
14 These use an electric element to heat the water to supply an existing radiator system.
15 Subject to the property needing heat, or the heat being stored in a hot water tank or storage heaters (I33).

4.2 Customers

GEM has one core customer: an energy supplier to which it sells electricity through a PPA. GEM initially had a PPA with Solarplicity;[16] as of 2019, GEM moved its PPA to Good Energy. Both suppliers specialise in electricity sourced from renewable energy.

However, GEM wishes to develop a different arrangement with suppliers to create a local energy tariff. Speaking in 2018, GEM's chair lamented the "gap … of ten pence a kilowatt" between what GEM received for selling electricity to the grid via its agreement with Solarplicity (at approximately 5.5p per kWh) and what the typical customer pays for the same volume of electricity (around 15p p/kW) (I22). It is hoped that partnering with a supplier for the creation of a local energy tariff would allow GEM to capture more value from the electricity that it exports to the grid (see Section 5).

4.3 Partners

In this section, the partnerships that GEM has formed are outlined. Key partners include: (1) MICT, (2) The Waterfall Fund, (3) Community Energy Scotland, (4) FLS and others.

4.3.1 Mull and Iona Community Trust – Community Charity

GEM's most important partner is MICT. GEM and MICT are legally separate, but they have been created to deliver the same mission statement: to improve wellbeing on the islands they aim to serve. Indeed, despite the legal separation of the two organisations, in practice it is not obvious where one organisation ends and the other begins. As we have seen, the Garmony Hydro project was initiated by MICT. We have also seen that the key agent of GEM is an employee of MICT. Moreover, as the general manager of MICT explains, "the vast majority of the board of directors of Green Energy Mull are members of MICT" (I22). The general manager of MICT is himself the chair of GEM. What is more, the key activities of the BenCom are in practice carried out by MICT (Section 4.1).

4.3.2 Waterfall Fund

A separate charity was created to disburse the surplus revenue of Garmony Hydro. On its board of trustees are a local councillor, community councillors, church minister, bank manager, head teachers and two island residents (The Waterfall Fund, 2019d).

There were two main reasons why a further charity was established to manage the surplus revenue generated by the hydro scheme. One was that the new charity would be able to apply for grants for projects, independently of its sister organisations of MICT and GEM. More significantly, there was the issue, again, of local opinion on the island. It was felt that wider community support for the project would be more likely if the profits were to be distributed across the island and not retained for the benefit of the Trust (I21). For this reason, it was considered better if it was "seen that [the hydro] wasn't just an income generator for the community trust" (I21).

However, the project manager believes that the earlier suspicion about MICT and its motives from segments of the community has abated, as the organisation has grown and its benefit has been more widely felt around the islands. He explains that, if MICT were to instigate another generation project, it "will definitely just be a community trust income generator" (I21). In other words, it would not create a new charity or use the Waterfall Fund to disburse funds. Instead MICT would receive the funds and use them to deliver on its objectives.

4.3.3 Community Energy Scotland – intermediary

CES works in partnership with community groups who wish to build their understanding and capacity to create a more democratic energy system (CES, 2019). From the outset of the hydro project, CES has provided advice and support, from feasibility grants (Section 4.5.4) to initiating the ACCESS project. CES put together the consortium bid to the Local Energy Challenge Fund which part financed the ACCESS project. They also facilitated the relationship between the MICT/GEM leadership and SSEN, VCharge and Element Energy, which underpinned the project.

4.3.4 Forestry and Land Scotland – landowner

Another significant partner of GEM is FLS, the Scottish Government agency tasked with managing and promoting Scotland's publicly owned forest estate. As noted previously, Garmony Hydro is sited on FLS land, and GEM holds a long-term (40-year) lease for the site, which it pays rent for (Section 4.5.2). GEM's project manager explains that with FLS "there [were] many hurdles to be jumped" but believes that this "would have been tenfold had we gone with the purchase option" versus the lease (I21).

At the time, purchasing the land from FLS would have been through the National Forest Land Scheme.[17] As explained by a member of MICT, the main reason for deciding against purchase was "because we needed a long narrow strip of land within a commercial operating forest environment. As the owner of such land, we would have been subject to legislation for protecting against deforestation, as well as involvement with operational issues" (I22), which they were not expert on. The leasing arrangement was considered the best solution, despite the annual ground rent due.

All in all, the experience of working with FLS was a positive one; the project manager says that it was an agency with which it was very easy to work (I21). The willingness of FLS to support GEM's hydro project is based on the close alignment between the two organisations' strategic objectives. Engagement with communities by all public bodies in Scotland is supported by the Community Empowerment (Scotland) Act 2015, which gives community organisations a right to request to take over publicly owned land or buildings, if the organisations can demonstrate they can make better use of the land for local people (Scottish Government, 2017). There is a presumption of agreement to such requests, unless there are reasonable grounds for refusal. Community groups can take over land, through either purchase or lease agreements via a Community Asset Transfer (FLS, 2018).

FLS has a responsibility to "maximise the contribution of the National Forest Estate to Scottish Government outcomes", which amongst other aims focus on "[reducing] the local and global environmental impact of our consumption and production", as well as "[having] strong, resilient and supportive communities where people take responsibility for their own actions and how they affect others" (FLS, 2018: 12). Underpinning this is the objective to "realise our full economic potential with more and better employment opportunities for our people" (ibid: 12). FLS responsibilities can be considered to be well aligned with GEM's plans for a community-managed hydro plant that provides local people with power and invests in community initiatives.

One of FLS's criteria for making land available was to demonstrate local support for the project through a ballot of the entire community (Forestry Commission Scotland, 2010). But this was a positive experience, as it allowed MICT to engage with the community about the plans for the project (I21). GEM has the option of renegotiating the lease after 40 years "so the scheme could be in place for many, many years" (MICT, 2014: 21).

4.3.5 Distribution Network Operator

GEM formed a partnership with SSEN, the network operator, during the ACCESS project. This relationship was managed by CES, with little interaction between GEM and SSEN (I24). It is not obvious how GEM directly benefitted from this relationship. The project helps demonstrate how a grid constraint could be managed by the use of smart technology, but, at the time, Garmony Hydro was no longer subject to a grid constraint (see Section 4.1). Furthermore, whilst the new heating systems remained, the smart grid was effectively disabled after the demonstration project (Section 4.4.1.2).

However, GEM might be understood to have benefitted indirectly from its relationship with SSEN during the ACCESS project. The project proved the workability of an approach to overcoming grid constraints, which benefits another community energy group on Mull – South West Mull and Iona Development (SWM&ID), with which GEM is informally linked (e.g. sharing board members) (I21) (see Section 4.4.1.2). As such, GEM's involvement in ACCESS improved GEM's social capital on the island. Moreover, should GEM at some point wish to embark upon another generation project, it will no longer suffer from the grid constraint, providing other options for the community energy group's development.

On the other hand, SSEN has capitalised directly on the ACCESS project. The principal benefit for SSEN in working with GEM was to demonstrate that it was possible, through innovative use of grid infrastructure, to "make better use of the network that's there" and thus potentially save significant costs in upgrading the existing grid infrastructure (I24). Secondly, SSEN has benefitted because ACCESS's outcomes have informed how SSEN has offered grid connections to other small-scale renewable generators in constrained areas (see Section 4.4.1.2). The elements of the project that concerned installing network technologies to manage transmission limitations have since been replicated "probably half a dozen or more" times elsewhere in Scotland (I24).

4.3.6 Other

GEM has employed a range of technical specialists to deliver the hydro project (I21). The design and construction project management was tendered and won by Campbell of Doune, a structural and civil engineering consultancy based in Crieff in central Scotland. Construction was tendered and won by TSL Contractors, a Mull-based Civil Engineering Company. Connection to the national grid was carried out by Integrated Utility Services, a power-engineering contractor which is a subsidiary of Northern Powergrid, the DNO for north-east England, Yorkshire and North Lincolnshire Ecological monitoring was carried out by the specialist Dr Phillip Radcliffe. Suppliers of the turbine and related equipment was Kestrel Controls, a family-owned manufacturer and supplier of electrical control. Maintenance is undertaken by Argyll Industrial Supplies (see Section 4.1).

GEM also has a partnership with VCharge,[18] which emerged from the ACCESS project. VCharge is now part of OVO Energy and GEM is in dialogue with the company regarding the establishment of a local energy tariff, one means through which the community energy group hopes to derive greater value from its existing energy asset (as discussed in Section 4.2 and 5).

4.4 Resources

4.4.1 Technological resources

The technologies deployed in the case of GEM can be separated into two categories: firstly, the technology deployed for generating electricity, a "run of the river" hydro power station; secondly, the technologies deployed, as part of the ACCESS project, for testing methods to actively manage generation and demand on the local network.

Hydro-electricity generator

Members of the community energy group were not fixed on any particular renewable technology. In the end, a run-of-the-river hydro facility was chosen for several reasons (Figure 2).

Figure 2: Garmony Hydro Scheme (MICT, 2019)

16 Solarplicity ceased to trade in August 2019 (Ofgem, 2019).

17 This has since been superseded by the Community Asset Transfer Scheme, following the Land Reform (Scotland) Act 2016 and the Community Empowerment (Scotland) Act 2015.

18 The provider of demand-side response (DSR) equipment and infrastructure oversaw domestic equipment removal for the ACCESS project (CES, 2018).

Firstly, it was envisaged that a hydro generator would provoke less opposition from the local community than would wind turbines. As the GEM project manager explains:

“[Y]ou could sort of split the island in two between those that think wind turbines are brilliant and those that [think they] are the scourge of the island [and] will murder everything that flies past and decimate the attraction for people coming” (I21).

Secondly, there was the ease of grid access. The feasibility study that MICT commissioned suggested wind was not viable, because the suitable sites were some distance from transmission lines, meaning that grid connection costs were prohibitive. In contrast, power lines ran near the preferred site for a hydro facility, making it the preferred choice in that regard.

Thirdly, the potential hydro site was just off the main road, so that access for construction purposes would be straightforward. However, “it was still tucked within an existing forestry plantation” and would therefore have little aesthetic impact on the wider landscape (I21).

Fourthly, being a run-of-the-river hydro scheme meant that the facility would not involve the creation of a reservoir, and so the impact on the landscape would be minimal. However, this created a greater threat of low- or no-power generation, following prolonged dry spells.

In general, the expectation that hydro would be met with less resistance versus other technologies (e.g. wind) was considered key when selecting a technology. Amongst other factors, this was because the site was on FLS land, and the FLS would only make the land available if the project had widespread support amongst local people (Forestry Commission Scotland, 2010). The island’s population was balloted. There was turnout of over 60% from the island’s total population, who voted 96.6% in favour of the scheme (MICT, 2014). “There were no major demonstrations or any negativity in building it at all” (I21), smoothing the way for the creation of the facility.

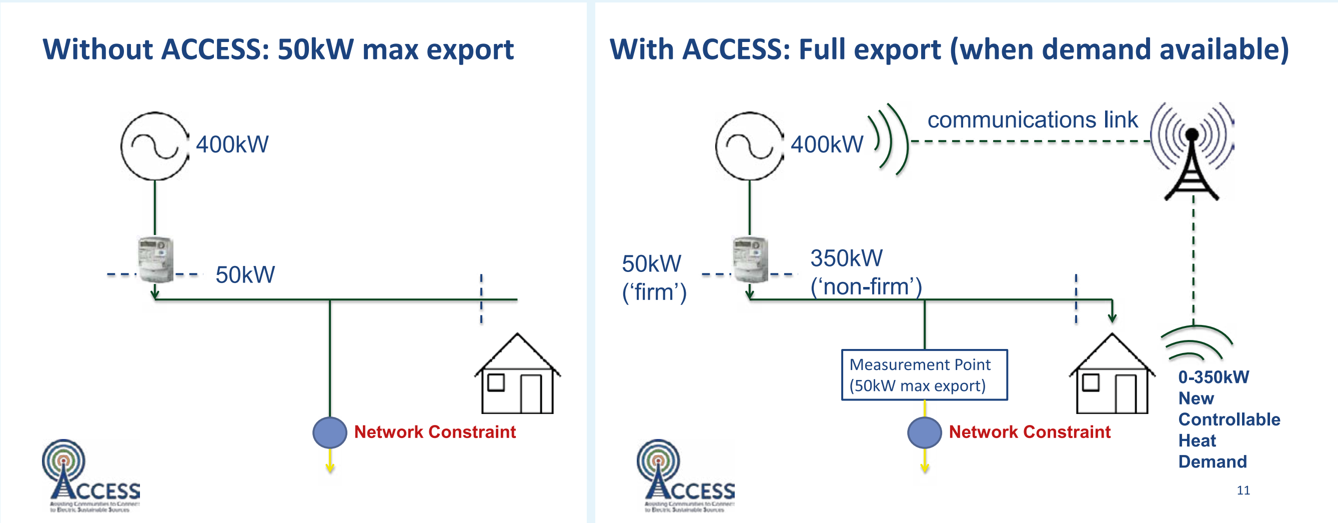
Ease of access to land also affected the scale of the facility. It would have been technically feasible to have built a larger hydro plant. However, land ownership issues deterred the group. The project manager says that the option existed, but doing so would have meant having to deal with two landowners: the FLS and another private landowner. They decided to keep the project small to “keep it as simple as we can" (I21). In this regard, a run-of-the-river hydro facility not only kept the project relatively small but also suited the river site, with minimum alterations needed, as opposed to having to dam the river to create a larger body of water.

Technologies for actively managing electricity generation and demand on the local network

Balancing local supply of electricity with local demand and safeguarding the broader grid infrastructure for non-firm grid connections constituted two key element of the ACCESS project. Balancing local supply and demand involved several key technologies. Some homes with storage heaters adequate for the experiment had controls retrofitted into the domestic heating systems. Others had Dimplex Quantum storage heaters installed. Homes that had LPG or oil heating saw these replaced with electric flow boilers, which use an electric element to heat the water to supply an existing radiator system (I22). The company VCharge also fitted monitoring equipment and remote switches on these systems, so that the amount of energy the systems used could be tracked and electrical heating loads could be switched on or off remotely to be matched with the electricity being generated at the hydro plant. Linking local generation to local supply whilst using existing grid infrastructure created a “virtual district heating” system (CES, 2015: 14), making use of surplus electricity to provide heat (I24).

To safeguard the broader network a “repeater” and an “inter-trip” were installed at the substation feeding the island of Mull (I22; I23). The repeaters were designed to make an additional signal from the local network available, which allowed the balance and supply of electricity on the island to be monitored.[19] If this signal indicated that there was imbalance and a fault condition was likely, then the inter-trip could disconnect Garmony Hydro remotely from the network.[20]

Figure 3: Before and after installation of the ACCESS network system (CES, 2015b)



The final report into the ACCESS project published by CES draws conclusions on these two key technological elements of the project. It states that it was “a significant achievement” that the project demonstrated “that local loads can be switched on and off remotely to match the power output of a hydro-electric generator” (CES, 2018a: 10).[21] The project demonstrated means to create tariffs, using the technology to link power produced locally to power consumed in individual local properties. Now proven, the intellectual property is available for licensed energy supply companies to attempt to monetise (I22). However, whilst the properties that had had new heating systems installed were permitted to keep them, the smart technologies which created a virtual district heating system were removed, and Garmony Hydro is no longer linked to the trial households.

Garmony Hydro, and Mull more broadly, were effectively a test-bed for the ACCESS project. Given that the hydro was not actually a constrained generator, there was effectively no commercial rationale for the smart grid equipment to be retained after the project (I33). In effect, the hydro has “a firm connection for the full capacity it can generate and is not dependent on the technology to generate and export its full output to the grid” (I22). However, as more generators are connected in the constrained area, the commercial deployment of such load-balancing systems is likely to become more attractive, as a means of reducing constraints on new generation. This situation could see the commercial application of the ACCESS project on the island in the future (I33).

The report also found that the “remotely-controlled inter-trip network solution is technically suitable for purpose and might therefore be used for new, otherwise constrained, generators” (CES, 2018a: 70). The inter-trip remains in place. Indeed, SSEN is rolling out the inter-trip signalling system across the DNO’s area as part of its new Alternative and Flexible Connections package (SSEN, 2018: 24). This package allows new generators in constrained areas to attain non-firm grid connections, which will enable them to export more power to the grid, and therefore generate more revenue from energy assets, than they would under firm but constrained grid connection agreements (see Section 4.1). It is through the Alternative and Flexible Connections package that South West Mull and Iona Development is currently pursuing a grid connection (I21). From the DNO’s perspective, the package also allows SSEN to connect greater generation in constrained areas, without the enormous expense of upgrading the network to eliminate the constraints.

The ACCESS project demonstrated that, under current circumstances (i.e. with the current level of constraint on a local network), the localised smart technologies deployed as part of the project to balance supply and demand across the island of Mull are not required to safeguard the grid infrastructure. This is on the condition that other technologies (e.g. repeaters and an inter-trip) are maintained upstream to safeguard supply in the grid constrained (I21).

More generally, the project demonstrated that the use of smart technology and more flexible grid connection agreements could allow existing grid infrastructure to accommodate increased renewable generation. All else being equal, this should assist in a more rapid roll-out of renewable technologies.

4.4.2 Human

The delivery of the hydro project has benefitted from the considerable skills and experience of the board and management team of GEM and MICT. In total, GEM has eight volunteer directors and MICT has ten.

Skills from engineering and management backgrounds are particularly evident. MICT’s general manager – and the chair of GEM – has a “background in mechanical engineering and construction and project management and design” (I22). GEM’s project manager was a “product manager for a financial software company” (I21). Another founding member of GEM and director owns and runs a hydraulic and Pneumatic Company and has “over 25 years’ experience in the fluid power industry” (MICT, 2012). MICT’s directors are drawn from “retailing, tourism, accommodation, education, farming … and commerce” (MICT, 2019c).

Interestingly, two of GEM's leading figures (its chair and project manager) report that they moved to the island of Mull from the mainland primarily for a lifestyle change (I21; I22).

4.5 Finances

4.5.1 Income

GEM recorded a turnover of £242,000 in the year ending March 2018, with its income based primarily on the sale of electricity and the FiT. It earned almost £40,000 from its PPA with Solarplicity. But this sum was dwarfed by the £191,000 it received from the FiT (GEM, 2019). In other words, of revenue derived from its energy asset (Garmony Hydro), 80% is derived from the FiT, with only 20% being from the sales of electricity to the supplier.

Two other sources of income are indicated in GEM’s accounts: Passthrough income of almost £8,000 in 2018 and income from other services of £4,000. The Director of GEM explained that some of the income might have stemmed from compensation for shutting down the hydro plant at times during the ACCESS project or through receipt of Generator Distribution Use of System (GDUoS)[22] or TRIAD[23] payments.

19 The repeater enabled a signal to be generated from the monitoring equipment of the substation which would allow “visibility of network data”, i.e. information about the balance of supply and demand in the local grid, to be available to the operators of Garmony Hydro (I24). If a fault condition became likely, the operators of Garmony Hydro had three minutes to intervene (I23). If no intervention was made, the inter-trip allowed SSEN to switch off the generator.

20 “SSEN assisted in the design of the inter-trip signalling” (CES, 2018: 73).

21 An SSEN report into the project put it like this: “The project demonstrated that a constrained generator can operate at its maximum output without impact on the electricity network, through controlling loads in the local area to make optimal use of surplus generation” (SSEN, 2018: 23).

22 “Relates to the positive charges and negative credits associated with the local distribution of exported electricity on to the grid. GDUoS for generators are calculated differently depending on where the generator is located and where they connect to the local electricity distribution network … if reinforcement works are required for things like transformers and cables in order to connect the generator to the local grid the generator in question will result in a positive charge” (Good Energy, 2016).

23 “TRIADs are a potential bonus for generating exported power at peak demand times. TRIAD periods measure the average demand on the Grid during three half hours between November and February each year” (Good Energy, 2016).

GEM secured a high FiT rate of 15.5p p/kW compared to that available for more recent projects, because the group had initiated the project early enough and attained a preliminary accreditation in 2012 (Green Energy Mull, 2014). This is secured for a period of 20 years from commissioning in 2015, providing revenue until 2035.

While the FiT provided a substantial and secure revenue stream over a long time horizon, building the business case for Garmony Hydro based on the FiT, however, has presented two key challenges for the community energy group. Firstly, it required all groups to source finance privately, due to state aid limitations:

"[T]he main overreaching restraint that you have is … if you want to claim the Feed-in-Tariff, you can't use public funding, because that would effectively double fund your project … you've got to go to private sector lenders to finance it" (I21).

Sourcing funds from the private sector was a particular challenge, because, as a third sector organisation, it was "certainly something that was alien to the community trust" (I21) (more detail in Section 4.5.4).

Secondly, to attain the FiT the project had to be delivered within a strict two-year schedule, creating a very tight deadline for a large and expensive project such as a hydro scheme. Had the deadline not been met, and the agreed FiT rate not been available at the date when the facility became operational, this may have jeopardised the viability of the project.

However, in general, the FiT is considered to have been essential for the financial viability of Garmony Hydro. Moreover, the project manager questions whether GEM would have been able to raise the finance for the project had pre-accreditation for the FiT not been in place. Without pre-accreditation, he says, the "banks wouldn't touch us" (I21).

4.5.2 Expenditure

GEM's operational expenditure totalled £146,000[24] in the year ending April 2018 (GEM, 2019). Besides depreciation[25] of £68,000, significant expenditure items included a donation of £35,000 to the Waterfall Fund (Section 4.5.3) and rent of £16,000 paid to FLS to lease[26] the Garmony Hydro site (Section 4.3.4).

Further costs included administration fees (£3,550), insurance (£5,650) and professional fees (including accountancy and legal fees) (£9,023), as well as £7,000 for cost of sales (e.g. maintenance and repair).[27] GEM also had to service £76,000 of finance interest, including £57,000 of loan interest and £19,000 of community share interest.

Once GEM's contribution to the community's Waterfall Fund was accounted for, GEM recorded a net profit of £20,000, which was carried forward for future use. For example, GEM sets aside £2,000 per annum for decommissioning (Green Energy Mull, 2014).

4.5.3 Surplus and Community Benefit Fund

Currently, the hydro donates about £35,000 a year of its surplus to a community benefit fund administered by The Waterfall Fund. Between April 2015 and the end of March 2018, £85,000 has been donated to the fund[28] (GEM, 2018, 2019).

The Waterfall Fund accepts applications for grants from Mull, Iona and the small neighbouring islands (e.g. Ulva, Gometra, Erraid) of up to £5,000 (The Waterfall Fund, 2019b). It is offered to projects that provide a "clear benefit to the community and will deliver transformational change" (The Waterfall Fund, 2019a), typically led by small organisations rather than large companies or statutory service providers. These span a broad range of activities that include, but extend beyond, renewable energy and energy efficiency initiatives (The Waterfall Fund, 2019c), such as in:

- affordable housing
- youth
- business and economic development
- cultural heritage and the arts
- spiritual, mental and physical wellbeing
- community care

Approximately half of the £85,000 fund has so far been committed to community projects (~£43,000) (The Waterfall Fund, 2019d). Thus far, the community benefit fund has contributed to a whole range of projects, ranging from £200 for new lighting for Tobermory Parish Church (in Mull's most populated settlement) to £5,000 for a minibus for Tobermory High School (see Appendix B for a full list of beneficiaries of the Waterfall Fund). The fund has also provided money for the start-up costs of a book festival, a pump for an aquarium and new shelving for a library (ibid).

Looking forward, the amount donated to the community fund by GEM will remain at around £20,000 – £30,000 per annum for the next 12–15 years, until it has paid back its debts. GEM is expected to achieve this aim in the early 2030s, when donations could grow to £150,000 per year, but only until the FiT payments are discontinued in 2035. After the FiT payments cease, donations are projected to drop back to between £20,000 and £30,000 per year (Green Energy Mull, 2014).

4.5.4 Funding and finance

GEM raised approximately £1.59m to deliver a 400 kW hydro facility, including all costs incurred during planning, design, installation and commissioning (LES, 2015: S1).[29] This was raised via a mixture of grants, shares and loans.

MICT obtained a grant of £20,000 from the Scottish Government-funded CARES for a feasibility study. A loan of £150,000, charged at 10% per annum, was also attained from CARES to cover all costs until financial close (LES, 2015). This development loan came with a write-off facility, "should the project fail to gain planning consent or meets another insurmountable obstacle" (LES, 2018). This helped de-risk the early stages of a project for the community group, when risk deters commercial banks (I5).[30]

Table 3: Funding and financing secured by GEM

Date	Type	Source	Amount (£)	Interest rate	Duration	Annual repayments	Notes
2010	Grant	CARES	£20,000	N/A	N/A	N/A	Feasibility study
2013	Soft loan	CARES Development Loan	£150,000	10%	N/A	Flexible duration, but to be repaid at financial close.	To cover costs prior to raising share capital. CARES loan would have turned into a grant, had the project failed. Covered costs such as procuring the installation contract, legal advice, marketing of share offer, project management ,etc.
2014	Community shares	Various small investors	£485,000	4%	N/A	Not fixed. In 2018, it was £19,200.	
2015	Loan	Charity Bank	£500,000	5.25%	15 years	£56,592 total debt interest paid in 2018	Senior lender
2015	Loan	REIF	£434,000	7%	12 years		Junior lender

(Sources: LES, 2015; interviews, GEM accounts)

To cover the capital cost of the project (as well as interest accrued from the CARES loan), GEM used a combination of shares and loans: a share issuance of £485,000 modelled on a 4% return per annum, a REIF loan of £434,000 at 7% (fixed rate) per annum for 12 years and a bank loan of £500,000 from the Charity Bank at 5.25% (variable rate) per annum for 12 years (S1) (Table 3).

It is also worth noting how the £2.5m ACCESS project was funded, with £1.8m coming from the Scottish Government's Local Energy Challenge Fund[31] and the rest from Ofgem's Electricity Network Innovation Allowance via SSEN (£0.3m) and (£0.4m) from project partners as contributions in kind, such as Element Energy, VCharge and the local council (CES, 2018).

GEM's 2018 accounts highlighted total debts of £900,000, £733,000 of which was due after more than one year. Whilst this is a considerable sum, GEM is dispensing with this debt at an impressive rate, reducing its total debt by £71,000 on the previous year (GEM, 2019).

Share finance

GEM was one of the very first community organisations in Scotland to raise share finance to deliver energy projects: "I don't think anybody certainly this side of the country had tried it" (I21). However, GEM was driven towards community shares, not through choice but necessity, with grant funding for construction unavailable and the administration of ordinary shares prohibitively expensive (see Table 2 in Section 3). Furthermore, since partial self-financing, in this case through community finance, was a necessary condition of potential lenders (see below), the community energy group had little option but to pursue the community shares option.

Yet, once they had explored the option, it made sense both ethically (as outlined in Section 3) and financially. GEM's financial modelling of the project proposed an annual return on the community shares of 4% (MICT, 2014), the cheapest form of finance available to the group. GEM's project manager explains: "our target was to fund the whole thing [with community shares]", but for a "small island scheme stuck in the back end of nowhere … it was always going to be [difficult]" (I21). Notably, however, the sufficiently attractive interest rate offered on the shares was only possible because of the FiT. As MICT's director explains, the project was instigated at a time when the "level of financial incentive from the Feed-in-Tariff still meant that it was viable financially to develop these projects" (I22). Ultimately, the share offer fell short of delivering the full cost of the project. Nonetheless, it exceeded the target of one third of the project costs.

The share offer was launched in November 2013 and, by mid-2014, £485,000 had been raised: £155,000 more than the £330,000 target. In retrospect, GEM's project manager considers it to have been a mistake to have launched the share offer in November. Whilst in the lead up to Christmas the offer went well, in January uptake "stopped dead" (I21). Only after the share offer was publicised nationally by the journalist and campaigner Lesley Riddoch, who published an article about the project in *The Scotsman* newspaper (see Riddoch, 2014), did interest pick up again. Investors are both local people and outsiders. GEM's key agent explains: "two thirds of those investors are pretty much from on the island or from people with close associations with the island" (I21).

Being an early pioneer of community shares had its disadvantages. The project manager understands that greater use and knowledge of community shares have improved the availability of this relatively cheap form of finance, since GEM's share offer. Given this increase in awareness, he stated: "I think if we said now we were going to do another share offer, we might get a whole lot more" (I21).

24 This includes administrative costs of £139,604, plus cost of sales of £6,669.
25 An accountant's estimation of the reduction in the value of tangible assets in a year.
26 The rent is set at 6% of GEM's gross income on the cost per kW of the scheme (I21). This assumes £1.4m cost and the turbine being rated at 400 kW.
27 A specialised contractor undertakes a maintenance check on the facility annually, and the intake grille at the weir is checked weekly to ensure it is clear of debris, at a cost of approx. £4,000 per year (Green Energy Mull, 2014).
28 We assume that all donations in GEM's accounts are to the Waterfall Fund.
29 This figure is derived by adding the total raised in community shares (£485,000), the total from both the CARES Loan (£150,000) and grant (£20,000), the REIF loan (£434,000), and the Charity Bank Loan (£500,000) as detailed by Local Energy Scotland (LES, 2015) and our survey (figures from the survey take precedence over those in the case study where there are discrepancies, for consistency).
30 As one interviewee puts it: "even a high interest loan that could be written off was a much better risk profile than taking out a loan of their own at 5%" (I5).
31 The fund aims to establish "low carbon demonstrator projects which show a local energy economy approach linking energy generation to energy use" (LES, 2019).

Loan finance

Initially, the group had approached various potential lenders, including both banks that specialise in more ethical finance and high street banks. However, the experience was often a frustrating and disheartening one. The project manager talked to ethical bank Triodos, but states: "we were actually too small for Triodos, they were looking at two million plus schemes". Lloyds TSB told the group that they only invested in solar and wind.

Eventually, the project manager came across two options which enabled the project. The first was Charity Bank, an ethical bank which is "owned by charitable and social purpose organisations" (Charity Bank, 2019). GEM's project manager describes Charity Bank as "a bank of the old school", i.e., "very risk adverse" that had "never done a hydro scheme in Scotland before". The other was the "semi-private" REIF, now called EIF, which is delivered by the Scottish Investment Bank, a fund run by Scottish Enterprise, a government agency, on behalf of the Scottish Government. The lenders agreed that, if the community energy group could raise one third of the sum for the construction of the facility themselves, then the two lenders would also contribute one third of the sum each. It is typical of the role of REIF to contribute partial funding. It is "a gap funder, and will only invest where there is a demonstrable funding gap in a project's funding package" (Scottish Enterprise, 2019). Its role is largely to act as a junior lender to "help de-risk" projects for the senior lender (I2).

Notably, the two lenders offered GEM different terms. The Charity Bank offered a relatively low interest rate of 5.25%. This is comparable to the interest rates that other community energy organisations achieve using community-based financing methods, such as shares or bonds.[32] The Scottish Government-backed REIF loan was more expensive, offering a rate of 7%. Importantly however, the Charity Bank rate is variable, while the REIF rate is fixed. So the Charity Bank's loan could become more expensive, depending on developments in the broader economy. The Charity Bank initially offered a fixed rate, but this was withdrawn late in the negotiations, meaning they settled on a variable rate loan.

The experience of working with the two lenders also differed. Whilst REIF offered a higher interest rate than the Charity Bank, the agreement with REIF was straightforward to arrange (I21). In contrast, the Charity Bank loan took some time to be ratified, mainly due to complications around the different legal jurisdictions of the project, with GEM based in Scotland and the Charity Bank registered in England.

32 For example, BHESCo, another one of our cases, issues shares modelled on a 5% return on investments. The most expensive financial instrument issued by Gwent Energy, another of our cases, is a bond with a 6% interest over 20 years, although this benefits the company by being longer-term debt in which only interest is paid for 20 years. (Cairns et al., 2020a, 2020b).

5 Future developments

Looking forward, MICT is reticent about pursuing another energy project, because financial returns are less attractive, largely because of the withdrawal of the FiT. If MICT were to instigate a new project now, it would deliver less surplus to be redistributed as community investment. GEM's project manager explains that, since Garmony Hydro was built, "construction costs have gone up and [the] Feed in Tariff [has] gone down" (I21). Consequently, without the FiT, the project's pay-back period is much longer and so the time when the community is "actually going to really start benefitting from it has gone probably from 12 years to over 30" (I21).

It is felt that the significantly longer pay-back period presented "a much more difficult story to sell" to investors and to the community (I21), with the former typically wanting a return on their investment, and the latter wanting to see tangible community benefits within a few years. However, GEM's project manager concedes that such a timeframe is still technically "doable" for a hydro scheme, which, after all, can last for 100 years. So the group will "monitor what's going on, on the island, to see if we could do another one" (I21). This might include partnering with a local private landowner.

The GEM project manager believes that the future of such projects will depend on what happens post-FiT. He says that, in the absence of FiTs, some other form of public support may be required, because "financially viable schemes need significant funding" (I21). Assuming the FiT is unlikely to recommence, he suggests that a return to grants or the introduction of state-backed interest-free loans would be a good route forward. This is because neither of these options imposes the burden of debt interest, making the overall cost of projects less expensive, in turn allowing a better return on investment and greater benefit to the community. Now that the ACCESS project has shown that actions can be taken to overcome some grid restraints, the funding issue for GEM is "the biggest restriction that we've got" (I21).

Instead of prioritising the development of a new asset, GEM is considering capturing more value from the asset which they already have: Garmony Hydro. In the short to medium term, they will pay off the debts owed to the two lenders, which will free up revenue to make more social investments on the island via the Waterfall Fund. In the longer term, they will also start buying shares back, again, to "maximise the amount of money we can put into community projects" (I21).

Perhaps more ambitiously, the group is exploring the creation of a local energy tariff. Indeed, this concept was an element of ACCESS (CES, 2015: 8), which appealed to the community energy group (I22). During the ACCESS project, one objective was to prove the technological basis on which the future deployment of a specific form of local tariff could be deployed (I33). This particular local tariff concept was to be based on the non-firm/'local load dependent' system activated during the project. In theory, it would allow a lower-cost tariff for electricity demand that matched constrained generation. Value would be shared between the generator (from the increased generation) and the electricity consumers, who would benefit from cheaper electricity by sourcing it at certain times. This is comparable to the concept of off-peak tariffs, where customers benefit from a cheaper tariff for using electricity at a time when there is little demand. But, instead, the ACCESS project would lay the foundations for a tariff that would be dynamically dependent on both the output of the hydro scheme and the level of constraint in the network.

A local generator would partner with a socially minded supplier, which would offer customers in the grid-constrained area a lower local tariff. The supplier would offer a local tariff for Demand Side Response-enabled load and contract with an aggregator to manage this demand (LES, 2018). In effect, "customers allow their load to be controlled in return for cheaper energy … which creates a portfolio of flexible load" (LES, 2018: 59). The aggregator is therefore able to match this demand to local supply, meaning the supplier is able to "procure generation cheaply from de-constrained local renewables … that would otherwise be curtailed at below market prices" (ibid).

The commercial arrangements were intended to be a subsequent phase, following the successful demonstration of the necessary technical arrangements, implemented at a future date subject to market developments and further funding (I33). This second phase has not yet been forthcoming. As the GEM project manager has put it, the local tariff idea "was looking very promising, but it fell by the wayside unfortunately" (I22).

However, MICT and GEM have still sought to advance the idea of a local tariff in discussions with potential partners, including OVO Energy, which purchased VCharge during the ACCESS project. From the perspective of GEM's leadership, a local tariff could see islanders pay less for their power per unit, compared with the standard market rate. GEM would also receive more for its power per unit than its current arrangements with Good Energy. GEM is especially interested in developing a tariff that might be means tested, to offer particular savings to those in fuel poverty (I22). The chief issue with this approach is whether a supplier utilising such a tariff could still maintain revenue sufficient to maintain its operations, something which GEM's chair recognises:

"[T]he question is whether a socially motivated electricity supply company could cover its costs and operate in that way to purchase electricity from the community generator and sell it to somebody in fuel poverty and still comply with all the legislative requirements of Ofgem" (I22).

GEM's leadership is therefore sceptical about the possibilities for developing a suitable partnership with a supplier in the near future, although its chair suggests that "it still might happen" (I22). If it does, then the legacy of ACCESS will more fully reflect its initial promise and provide Mull with greater lasting benefit.

6 Key lessons

1. Government subsidy is the cornerstone to securing community and external finance

The FiT accounts for roughly 80% of GEM's annual revenue. It provides a 20-year guarantee of a revenue stream that is at least double the per unit revenue it receives via its PPA. GEM's story points to a financing chain in which securing the FiT meant that it was able to raise significant share capital via a competitive interest rate. This in turn enabled GEM to raise further finance from institutional investors and government-backed finance schemes.

Removing the FiT increases the project risk for investors, blocking access to share or debt finance. In effect, the subsidy acted as the cornerstone to securing finance for Mull's community energy project. Furthermore, the FiT is an operational subsidy, and, in order to access it, community energy organisations must secure capital financing because they lack upfront capital. Discontinuing the FiT removes both a key motive and an opportunity to secure project finance.

2. The limits of community finance in low population or less affluent areas

Despite overwhelming support from the community for the project, and successfully raising £485,000 in shares, community finance still covered only about 30% of the total investment needed. GEM's inability to raise enough finance locally meant it relied on loans from a combination of government-backed schemes and ethical institutional investors. The story of GEM reflects the challenges of raising finance from a rural location with low population density and a below-average disposable household income.

3. Loan finance expensive and/or difficult to secure from both public and private sector

An inability to raise sufficient funds via community shares necessitated the sourcing of more expensive loan finance, i.e. above a 4% interest rate. Sourcing loan finance for a small-to-medium-sized generation project also proved a challenge. The Garmony Hydro project found itself 'caught in the middle': it was too large to be entirely financed by community finance, but too small to be of interest to high street banks or a major social lender such as Triodos. GEM had little option but to turn to alternative, socially motivated, lenders. Funds were a challenge to secure, partly because share financing of community energy was a rarity at the time, and the Charity Bank became involved in the bank's first energy project in Scotland.

Importantly, the Charity Bank offered a lower interest rate to GEM than the Scottish-Government backed REIF: 5.25% versus 7%.[33] This raises questions about such state-backed finance schemes, if the marketplace is offering commercial loans at a lower cost; whilst state aid regulations dictate that government loans cannot dramatically undercut commercial ones, they could at least be revised to better reflect what the marketplace is offering.

4. Communities present important test beds for innovation, but direct long-term benefits may not be forthcoming

As part of the ACCESS project, GEM demonstrated the important role community energy groups can play as trusted intermediaries to recruit local residents for technology demonstration projects, helping create a space for experimentation. The project demonstrated: a) the practical application of smart grid balancing services; and b) the viability of local network safeguards to manage peaks in supply and/or troughs in demand on constrained network areas. The latter has benefitted the DNO, which has been able to use the insights to offer new flexible connections to new generators in constrained areas, without major upgrades to the network infrastructure.

The project has demonstrated the potential to export more electricity to the grid safely through non-firm grid connections, making connection easier for decentralised generators on Mull and elsewhere. However, there are questions about the extent to which the Mull community has directly benefitted from the project. For example, the technology that facilitated the balancing of local supply (i.e. hydro) and demand (i.e. electrical heat) was removed, even though the new electrical heating systems were left in place, which eliminated another possible route to market for Garmony Hydro.

The project also sought to lay the foundations for a local flexible energy tariff but this has not yet been forthcoming. GEM's story is, therefore, one that highlights how communities offer an important space for experimentation but how safeguards are needed to ensure that they enjoy long-term benefits from acting as test beds for new technology.

5. Partnerships with public land owners critical to project delivery

The Garmony Hydro project relied on a major public landowner – Forestry and Land Scotland – making land available for lease. This partnership was built on both parties sharing certain social and environmental objectives, with FLS making the land available for a not exorbitant fee. Landowning organisations with a strong emphasis on public and environmental value are critical to making available the necessary land to deliver larger-scale community energy projects, assuming that the community does not have control over suitable land itself.

6. Legal structures are shaped by finance and risk

The decision to establish a BenCom was based predominantly on the decision to establish GEM as a 'special purpose vehicle' to raise shares, something which the parent organisation MICT, as a CLG, could not do. The factors shaping this decision included MICT's leadership wishing the hydro project was at 'arms length', to insulate the development trust from financial risk, and that the BenCom model offered the potential for raising significant finance through community shares.

33 Notably, the 10% interest from the CARES loan is even more expensive. However, the CARES loan is for the earlier and risker development stage of the project (I5).

7 Acknowledgements

We would like to thank the many contributors who have made the completion of this case study possible. In particular, assistance and invaluable contributions have been made by the members, staff and volunteers of the Mull and Iona Community Trust, Repowering London and Scottish and Southern Electricity Networks.

8 References

Bird, L., Cochran, J. and Wang, X. (2014). *Wind and Solar Energy Curtailment: Experience and practices in the United States.* doi: 10.2172/1126842.

Braunholtz-Speight, T., Mander, S., Hannon, M., Hardy, J., McLachlan, C., Manderson, E., & Sharmina, M. (2018). *Evolution of Community Energy in the UK. (September)*, 55. Retrieved from http://www.ukerc.ac.uk/publications/evolution-of-community-energy-in-the-uk.html

Cairns, I. et al. (2020a). *Financing Community Energy Case Studies: BHESCo.* London: UKERC. DOI https://https://doi.org/10.17868/69790

Cairns, I. et al. (2020b). *Financing Community Energy Case Studies: Gwent Energy CIC.* London: UKERC. DOI https://doi.org/10.17868/69789

CES (2015). *Smarter Energy, Connecting Communities: An Introduction to the Mull ACCESS project.* Available at: https://www.argyll-bute.gov.uk/sites/default/files/Unknown/access_argyll_and_bute_les_9_9_15.pdf.

CES (2018). *The ACCESS Project: 'Assisting Communities to Connect to Electric Sustainable Sources' Final Report prepared for Local Energy Scotland Reporting Period: March 2015 to May 2018.* LES. Available at: https://www.localenergy.scot/media/110697/the-access-project-final-report.pdf.

CES (2019). *Community Energy Scotland - About Us.* Retrieved 2 August 2019, from http://www.communityenergyscotland.org.uk/about-us.asp

Charity Bank (2019). *Ethical bank? Prove it! - Charity Bank.* Retrieved 2 August 2019, from https://charitybank.org/news/ethical-bank-prove-it

Community Shares Unit (2019). *The Community Shares Handbook.* Retrieved 2 August 2019, from https://communityshares.org.uk/resources/handbook

Databuild (2014). Community Energy in the UK: Part 2 – final report, report to the Department of Energy and Climate Change, London: DECC.

Džamarija, M. and Keane, A. (2013) 'Firm and non-firm wind generation planning considering distribution network sterilization', IEEE Transactions on Smart Grid. IEEE, 4(4), pp. 2162–2173. doi: 10.1109/TSG.2013.2263676.

FLS (2018). Community Asset Transfer Scheme Community Empowerment (Scotland) Act 2015 2nd Annual Report; 1 April 2018 to 31 March 2019, FLS website, pp. 1–9. Available at: https://forestryandland.gov.scot/images/corporate/pdf/FLS_Community_Empowerment_Annual_Report_2_-_June_2019.pdf

Forestry Commission Scotland (2010). *National Forest Land Scheme progress report.* Available at: http://scotland.forestry.gov.uk/images/corporate/pdf/fcs-nfls-summary-report.pdf.

Forestry Commission Scotland (2019). Forestry Commission Scotland and Forest Enterprise Scotland no longer exist. Retrieved 2 August 2019, from https://scotland.forestry.gov.uk/.

Good Energy (2016). *Generator glossary.* Available at: https://www.goodenergy.co.uk/media/1403/generatorglossary.pdf.

Green Energy Mull (2014). *Garmony Hydro - Share Offer.* Available at: https://web.archive.org/web/20160706151947if_/http://www.garmonyhydro.info/wp-content/uploads/2014/01/Green-Energy-Mull-Share-Offer-V1.2.pdf.

Green Energy Mull (GEM) (2018). GEM: *Annual Return and Accounts 2016/2017.* Available at: https://mutuals.fca.org.uk/Documents/Download/85208.

Green Energy Mull (GEM) (2019). GEM: *Annual Return and Accounts 2017/2018*. Available at: https://mutuals.fca.org.uk/Documents/Download/75204.

LES (2015). *Garmony Hydro Mull: case study.* LES. Retrieved 2 August 2019, from https://www.localenergy.scot/media/80819/Garmony-Case-Study.pdf

LES (2018). *CARES Development Loan.* Available at: https://www.localenergy.scot/media/110275/development-loan-guidance-2018.pdf.

LES (2019). *Local Energy Challenge Fund - Local Energy Scotland.* Retrieved 2 August 2019, from https://www.localenergy.scot/funding/local-energy-challenge-fund/

LES and Ricardo Environment (2018). *Local Energy Challenge Fund Case Studies: Using electricity locally*. Retrieved 2 August 2019, from https://www.localenergy.scot/media/110230/cares-toolkit-innovative-energy-systems-module_v5.pdf

MICT (2012). *Mull and Iona Community Trust Garmony Hydro Business Plan*. Mull and Iona Community Trust. MICT.

MICT (2014). *Green Energy Mull - Garmony Hydro - An invitation to invest in the first community owned hydroelectric generation scheme on Mull.* MICT. Retrieved 2 August 2019, from http://www.garmonyhydro.info/wp-content/uploads/2014/01/Green-Energy-Mull-Share-Offer-V1.2.pdf

MICT (2019a). *About | Mull and Iona Community Trust*. Retrieved 19 August 2019, from http://www.mict.co.uk/about-us/

MICT (2019b) Garmony Hydro Scheme | Mull and Iona Community Trust. Retrieved 19 August 2019, from https://www.mict.co.uk/projects-services/garmonyhydro/ (Accessed: 4 June 2019).

MICT (2019c) Directors of Mull and Iona Community Trust. Retrieved 12 August 2019, from https://www.mict.co.uk/about-us/directors/

Ochoa, L. F., Dent, C. J. and Harrison, G. P. (2010) 'Distribution network capacity assessment: Variable DG and active networks', IEEE Transactions on Power Systems, 25(1), pp. 87–95. doi: 10.1109/TPWRS.2009.2031223.Ofgem (2019). *Ofgem protects customers of failed supplier Solarplicity.* Retrieved 19 August 2019, from https://www.ofgem.gov.uk/publications-and-updates/ofgem-protects-customers-failed-supplier-solarplicity.

Riddoch, L. (2014) 'Share in community-led enterprises', *The Scotsman*, 19 January. Available at: https://www.scotsman.com/news/opinion/lesley-riddoch-share-in-community-led-enterprises-1-3274437.

Scottish Enterprise (2019). Energy Investment Fund (EIF). Retrieved 31 July 2019, from https://www.scottish-enterprise.com/support-for-businesses/funding-and-grants/accessing-finance-and-attracting-investment/energy-investment-fund.

Scottish Government (2017). *Community Empowerment (Scotland) Act: summary.* Retrieved 2 August 2019, from https://www.gov.scot/publications/community-empowerment-scotland-act-summary/.

Smith, G. and Teasdale, S. (2012). Associative Democracy and the Social Economy: Exploring the regulatory challenge. Economy and Society, 41 (2), pp. 151–76. doi: 10.1080/03085147.2012.661627.

SSEN (2018). *Network Innovation Allowance Summary Report.* Scottish and Southern Electricity Networks.

The Waterfall Fund (2019a) *Eligibility*. Retrieved 29 July 2019, from https://www.thewaterfallfund.co.uk/.

The Waterfall Fund (2019b). *Funding Options*. Retrieved 29 July 2019, from https://www.thewaterfallfund.co.uk/funding-options.

The Waterfall Fund (2019c). *Guidelines.* Retrieved 29 July 2019, from https://www.thewaterfallfund.co.uk/guidelines.

The Waterfall Fund (2019d). *Recipients of the Waterfall Fund.* Retrieved 29 July 2019, from https://www.thewaterfallfund.co.uk/recipients.

Thorlby, S. (2011). *Finance and Business Models for Supporting Community Asset Ownership and Control.* York: Joseph Rowntree Foundation. Retrieved 29 July 2019, from https://www.jrf.org.uk/sites/default/files/jrf/migrated/files/community-assets-business-models.pdf

UK Government (2014). *Community Energy Grid Connections Working group report to the Secretary of State.* Available at: https://www.ofgem.gov.uk/ofgem-publications/91618/gridconnections.pdf.

Appendix A – List of interviewees

Ref	Role	Organisation type	Date
S1 (Survey)	N/A	N/A	TBC
I2 (Interview)	Manager	Government	Aug 2018
I5	Energy Systems Manger	Community energy intermediary	Aug 2018
I21	Project Officer	Community energy organisation	Oct 2018
I22	Director	Development Trust	Oct 2018
I23	Research and Development Engineer	DNO	Nov 2018
I24	Energy Strategy Manager	DNO	Nov 2018
I33	ACCESS Project Manager	Community energy intermediary	August 2019

Appendix B – List of beneficiaries of the Waterfall Fund to May 2018

Recipient	Amount	Purpose	Date of Award
Dervaig Community Hall	£2,000	Hall refurbishments	May 2018
Iona Football Club	£1,000	New football goals	May 2018
Headland Explorations	£500	Climbing equipment	May 2018
Tobermory Book Festival	£500	Start-up costs	May 2018
Seahawks Cheerleading Academy	£500	Start-up costs	May 2018
Tobermory Fire Cadets	£1,500	New uniforms	May 2018
Mull & Iona U3A	£500	Advertising, printing, accommodation and training	May 2018
Air Ghleus	£1,500	Mod tuition	Jan 2018
Ross of Mull Historical Centre	£1,200	New website construction	Jan 2018
Mull First Aid	£1,400	Pain relief equipment	Jan 2018
Mull Mod	£500	Creating a Mull song book	Jan 2018
Iona Primary School Parent Council	£1,910	Summer camp for Iona primary pupils	Jan 2018
Mull Highland Games	£1,500	New shed	Jan 2018
Comar	£500	Visual arts programme	Jan 2018
Mull Aquarium	£2,000	New pump	Jan 2018
Mull and Iona Community Enterprise (MICE)	£3,500	Swimming lessons for primary schools	Oct 2017
Tobermory High School Parent Council	£5,000	Minibus for Tobermory High School	Oct 2017
Isle of Mull Bird Club	£500	Match funding for new high-quality projector	Oct 2017
South West Mull and Iona Development	£1250	Equipment for office at the Columba Centre	Oct 2017
Tobermory Snooker Club	£485	Windows and doors renewal	Jun 2017
Craignure Golf Club	£2,000	Water to club house	Jun 2017
Western Isles Yacht Club	£1,000	New storage container	Jun 2017
Mull Runners	£1,100	Electronic chip timing system	Jun 2017
Dervaig Community Library	£982	Shelving for new library	Jun 2017
Mull Community Council	£500	Restoration of Dugald MacPhail monument	Jun 2017
Tobermory Golf Club	£1,415	Fencing and signage for golf course path	Jun 2017
Tobermory Primary Gaelic Choir	£1,000	New kilts	Jan 2017
Tobermory Parish Church	£200	New outside lighting	Jan 2017
NHS and A&BC Youth Services	£1,420	Health and Wellbeing Club at Tobermory Primary School	Jan 2017
Aros Hall	£2,000	Replacement windows	Jan 2017
Isle of Mull Gaelic Choir	£800	Production of a CD	Oct 2016
Mull Safe and Sound	£2,000	Initial set up costs of running group	Oct 2016
Lochbuie Mobile	£325	Mobile signal booster	Oct 2016
Dervaig Community Orchard	£1,000	Fencing for orchard	Oct 2016
Ulva School Community Association	£1,956	Equipment for first responder bag	Oct 2016
Craignure Playpark	£5,000	New equipment	Oct 2016
Hebridean Whale and Dolphin Trust	£500	Improvements to shop front	Oct 2016

(Source: Waterfall Fund, 2019d)

Appendix C – Key features of common legal structures

Legal structure	Governance	Limited liability	Fundraising	Asset lock	Charitable status	Notes
Community Benefit Society (BenCom)	One shareholder, one vote. Run for benefit of (defined) community.	Yes	Grants, community shares, loans, bonds.	Yes	Possible	Prioritises community benefit; typically lower returns on investment than co-ops.
Bona fide cooperative	One shareholder, one vote. Run for the benefit of members.	Yes	Community shares, loans, bonds. Excluded from some grants and loans, e.g. CARES grants and loans.	No	Difficult	More flexibility with returns to investors. Financial Conduct Authority places conditions upon grid export.
Community Interest Company (CIC)	Voting rights depend on whether CLG or CLS status. Run for defined social purpose.	Yes	Grants, ordinary shares (capped returns), loans, bonds.	Yes	No	Expensive to raise equity investment. Light touch regulation.
Company Limited by Guarantee (CLG)	Membership organisation with flexible structure. Often nominal (£1) membership fee. One member one vote common.	Yes	Grants, ordinary shares (capped returns), loans, bonds.	Possible	Possible	Different categories of members with different voting rights possible. No equity investment possible.
Charitable Incorporated Organisation/ Scottish CIO	Membership appoints board of trustees.	Yes	Grants, loans, bonds.	Yes	Yes	Strictly regulated. No equity investment possible.
Charitable Trust (unincorporated)	Board of trustees.	No	Grants, loans, bonds.	Yes	Yes	Strictly regulated. No equity investment possible.
Private Company Limited by Shares (CLS)	One share, one vote.	Yes	Grants, loans, (privately exchanged) ordinary shares, bonds.	No	No	Shares cannot be made available to the public.
Public Limited Company (PLC)	One share, one vote.	Yes	Grants, loans, publicly offered ordinary shares, bonds.	No	No	Structure familiar to institutional investors. Strictly regulated. Expensive to raise equity finance.

(Source: Community Shares Unit, 2019; Databuild, 2014; Smith and Teasdale, 2012; Thorlby, 2011; I2; I4; Braunholtz-Speight et al., 2018.)